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**EUROPEAN PATENT APPLICATION**

(21) Application number: 84111025.7

(51) Int. Cl.<sup>4</sup>: **B 41 F 23/04**  
**F 26 B 3/28**

(22) Date of filing: 27.08.82

(30) Priority: 02.09.81 US 298575

(43) Date of publication of application:  
20.03.85 Bulletin 85/12

(84) Designated Contracting States:  
DE FR GB IT SE

(60) Publication number of the earlier application  
in accordance with Art. 76 EPC: 0 073 669

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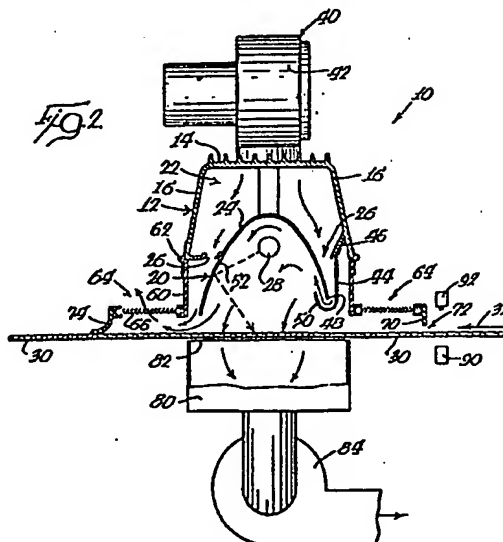
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(54) Curing apparatus.

(57) An apparatus for use in curing articles with light from an ultraviolet lamp (28) has a conveyor (30) on which articles are passed under the lamp (28) which is contained in a housing (12), the conveyor exit and entry sides of the housing (12) being provided with baffles (64) which prevent escape of light from the housing (12) while allowing air flow there-through to enhance cooling within the housing (12).



CURING APPARATUS

The present invention relates to curing apparatus for use in screen printing and more particularly, but not exclusively, to apparatus for curing photopolymerizable inks applied to flat and three-dimensional articles.

The use of ultraviolet light sources for curing screen printed articles has been known for some time. However, one of the shortcomings of known apparatus is the fact that they develop an excessive amount of heat. Thus, known types of ultraviolet curing apparatus have required a large housing to house the ultraviolet light source in a condition to dissipate the heat generated, and also for the dissipation of ozone generated by the ultraviolet light source.

In US-A-4143278 there is disclosed curing apparatus comprising a housing in the form of an elongate substantially U-shaped cross-section member; a curing lamp mounted in the housing; a reflector shield mounted in the housing and partially surrounding the lamp, the shield having an outer surface spaced from the inner surface of the housing; conveyor means adapted and arranged to convey articles to be cured past the open faces of the housing and shield thereby to be exposed to radiation from the lamp; baffle means extending outwardly from both free edges of the housing over the conveyor means and serving to prevent radiation from the lamp escaping from the apparatus; and blower means for producing a flow of cooling fluid through the space between the outer surface of the shield and the inner surface of the housing.

In order to achieve satisfactory heat dissipation the known apparatus includes coolant carrying pipes arranged between the lamp and an article to be cured, which pipes serve to block a portion of the radiation from the lamp thereby restricting the direct heating of the article while the coolant in the pipe serves to withdraw  
5 of the article while the coolant in the pipe serves to withdraw heat from the apparatus.

A disadvantage of this known apparatus is that it is relatively complex and thus is expensive to manufacture and operate.

According to this invention an apparatus as set out above  
10 is characterised in that the baffle means allows air flow there-through.

The apparatus of this invention has the advantages that efficient cooling is achieved in a simple and thus relatively cheap manner.

Preferably the baffle means is in the form of overlapping  
15 V-shaped elements that co-operate to prevent passage of light there-through while permitting air flow therethrough.

The baffle means at the article exit edge of the housing can have a wiper element secured thereto, which engages the conveyor means, thereby to close the housing at that edge.

20 An apparatus according to this invention will now be described by way of example with reference to the drawing, in which:-

Figure 1 is a perspective view of the apparatus; and

Figure 2 is a cross-sectional view along line 2-2 Figure  
1.

25 The drawing shows a curing apparatus generally designated by reference numeral 10, comprising an elongate, generally inverted U-shaped housing 12 that has a top wall 14 and side walls 16.

An elongate, generally U-shaped elliptical reflector 20 is located in the lower open end of housing 12 and cooperates therewith to define an elongate chamber 22. The outer surface 24 of reflector shield 20 is spaced from the adjacent lower edge of housing 12 to define elongate slots 26, for a purpose that will be described later.

A conventional ultraviolet lamp or tube, such as a mercury vapor tube, 28 is located within reflector 20.

In practice, an article having a coating of ink or other material therein is supported on a porous conveyor belt 30 moving in the direction indicated by arrow 32 to pass below the lower open end of the chamber 22 and reflector shield 20 while ultraviolet light is being produced by the lamp 28 to cure the coating.

The apparatus includes blower means 40 supported on top of upper wall 14 of housing 12 for directing cooling air into chamber 22. In the specific embodiment illustrated, the blower means is in the form of three spaced fans 42, each of which directs cooling air into the chamber 22 to flow along the outer surface 24 of reflector shield 20.

The apparatus also includes deflector means for deflecting at least some of the cooling air to flow along the inner surface of the reflector shield to prevent heat build-up along the surface. As shown in Figure 2, the deflector means is in the form of an extension 44 extending from the leading lateral edge 46 of housing 12 downwardly below the lower leading lateral edge 48 of the reflector

shield. Extension 44 has a substantially C-shaped end portion 50 that extends around lateral edge 48 so that the cooling air flow through slot 26 adjacent leading edge 46 of housing 12 is directed around lateral edge 48 and upwardly along the inner surface 52 of reflector shield 20.

The deflector 50 is designed such that the cooling air flowing along the inner surface 52 of reflector shield 20 does not impinge directly upon the ultraviolet light source 28 so that the efficiency of the unit is increased. The cooling air flowing along inner surface 52 is also directed downwardly at the trailing edge of reflector shield 20 towards an article on belt 30 to partially cool the article as it is exiting from the apparatus. This method of cooling substantially reduces the amount of cooling space necessary for operating at a temperature level necessary when working with heat-sensitive fabrics.

One of the other problems inherent in an ultraviolet light curing apparatus of the type envisioned herein is the fact that the apparatus emits ultraviolet light rays, and also ozone which is generated by the light source and which is preferably not exhausted to the surrounding atmosphere.

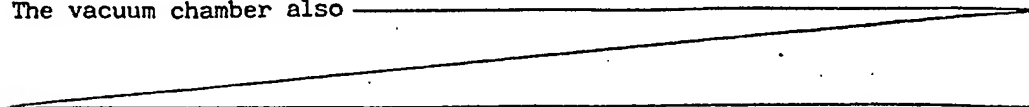
The curing apparatus 10 thus also incorporates baffle means adjacent the entrance and exit of the unit to prevent any light from escaping to outside of the apparatus. The baffle means is illustrated in Figure 2 and includes an extension 60 extending from the lower edges 46 of housing 12, being connected by a hinge

structure 62. The baffle means 64 extends laterally from the lower edge of extension 60 and is designed to allow air to pass therethrough while preventing any light from being reflected directly from the conveyor 30. As shown, the baffle means 64 is in the form of overlapping V-shaped elements or chevrons 66 that cooperate to define a continuous surface preventing reflection of light therethrough while being spaced from each other to allow air flow. A plate or element 70 extends from baffle means 64 along the leading edge of the curing unit to define a small entrance space 72 between the top surface of conveyor belt 30 and the lower edge of extension 70. Also, the baffle means adjacent the trailing end of the curing apparatus may have a wiper element 74 secured thereto and designed to engage the top surface of belt 30 and define a closed chamber between the baffle means 64 and belt 30.

The chevron structure of the baffle means 64 creates a condition such that any ultraviolet light rays that enter therein bounce back and fourth until extinguished without being allowed to pass through the baffle means.

The ozone that is normally generated within the system is automatically withdrawn and prevented from exiting into the surrounding atmosphere. For this purpose, a vacuum chamber 80 having a porous upper surface 82 is located below the conveyor 30 and has a vacuum source 84 connected thereto. Thus, any ozone that is generated under reflector shield 20 is drawn into the vacuum chamber 80.

The vacuum chamber also



aids in holding articles on the surface of the conveyor 30.

The upper surface 82 may be configured in the same manner as the baffle means 64 to reflect any  
5 ultraviolet light rays while allowing air and ozone within the air to be drawn therethrough.

The apparatus is also designed to minimize energy consumption, by incorporating sensor means for sensing the presence and absence of an article to be  
10 cured and controlling the output of lamp 28 in response thereto. As shown in Figure 2, the sensor means is in the form of a photocell 90 located below conveyor 30 and a receiver unit 92 located above conveyor 30.

When an article is present on the conveyor and passes  
15 between receiver 92 and photocell 90, the lamp 28 is activated to the desired lamp wattage output until such time as the trailing edge of the article passes across the receiver unit whereupon the lamp is deactivated. If desired, the lamp wattage could be  
20 operating continuously at a low output and increased significantly when an article is present. Suitable time delays are incorporated into the control system to delay the signal until the article is physically under the reflector shield 20.

25 As can be appreciated from the above description,

the apparatus described is a compact modular unit that can easily be installed in a confined space and which does not allow any harmful ozone or ultraviolet light to escape from the apparatus. The cooling of the apparatus is such that the surface of the reflector shield  
5 which absorbs most of the heat from the reflecting light rays is cooled at all times thereby producing a lower operating temperature while still allowing the lamp to be at the preferred temperature of 1200°-1300°F. The hinged extensions 60 allow for easy access to the lamp for maintenance and replacement.

10       Apparatus as described above is also described in European Patent Application No 82304547.1, Publication No 0073669, from which this application has been divided.

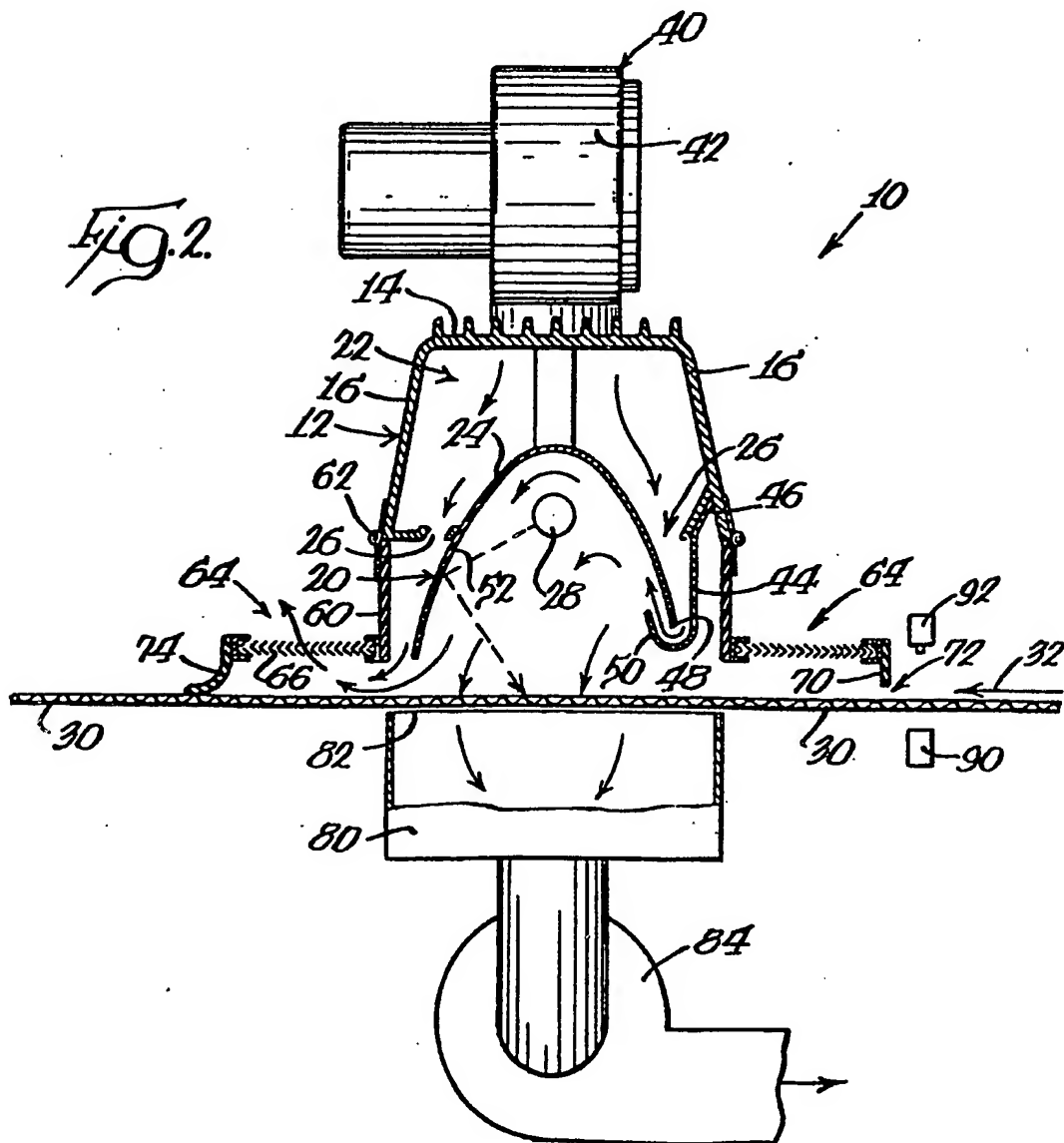
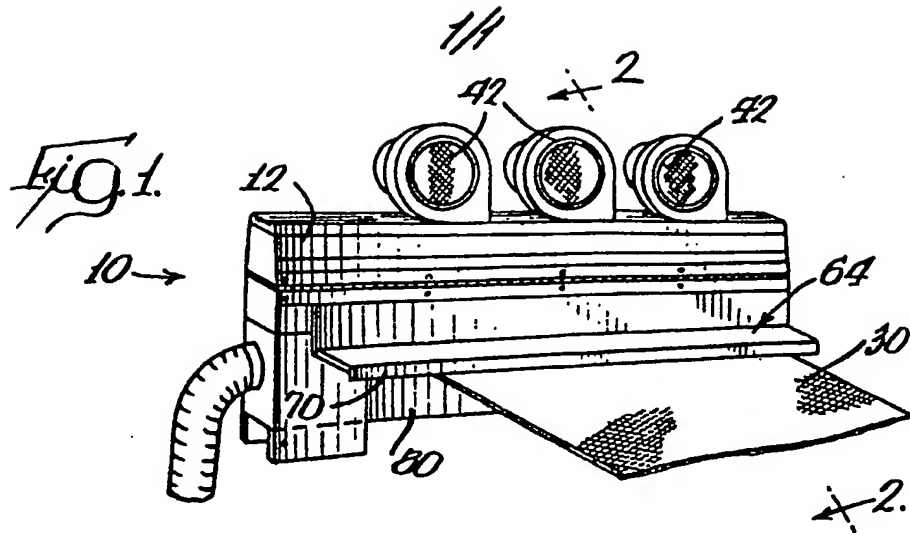


CLAIMS:

1. Curing apparatus comprising a housing (12) in the form of an elongate, substantially U-shaped cross-section member; a curing lamp (28) mounted in the housing (12); a reflector shield (20) mounted in the housing (12) and partially surrounding the lamp (28), the shield (20) having an outer surface (24) spaced from the inner surface of the housing (12); conveyor means (30) adapted and arranged to convey articles to be cured past the open faces of the housing (12) and shield (20) thereby to be exposed to radiation from the lamp (28); baffle means (64) extending outwardly from both free edges of the housing (12) over the conveyor means (30) and serving to prevent radiation from the lamp (28) escaping from the apparatus; and blower means (40) for producing a flow of cooling fluid through the space between the outer surface (24) of the shield (20) and the inner surface of the housing (12), characterised in that the baffle means (64) allows air flow therethrough.

2. Apparatus as claimed in Claim 1, characterised in that the baffle means (64) is in the form of overlapping V-shaped elements (66) that cooperate to prevent passage of light therethrough while permitting air flow therethrough.

3. Apparatus as claimed in Claim 1 or Claim 2, characterised in that the baffle means (64) at the article exit edge of the housing (12) has a wiper element (74) secured thereto, which engages the conveyor means (30).





European Patent  
Office

# EUROPEAN SEARCH REPORT

0134591  
Application number

EP 84 11 1025

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Y	GB-A-1 455 053 (THERMOGENICS) * Whole document *	1,2	B 41 F 23/04 F 26 B 3/28
A	---	3	
Y	US-A-4 037 329 (WALLACE) * Whole document *	1,2	
A	US-A-4 143 278 (KOCH, II) * Whole document *	1,3	
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			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			B 41 F F 26 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-11-1984	Examiner RECHLER W.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons  & : member of the same patent family, corresponding document	